DRAFT Virginia Runoff Reduction Method, 08/15/08
Description of Overall Process

NOTES ON THE METHOD

- **Total Phosphorus (TP)** used as keystone pollutant. Total Nitrogen (TN) is also calculated and BMP designs address TN removal, but compliance is based on TP.
- Each site also has a **Treatment Volume (Tv)** that is based on post-development land covers. The method uses more than just impervious cover to compute the Tv.
- BMPs are assigned **Runoff Reduction (RR)** and **Pollutant Removal (PR)** rates. Rates vary for Level 1 and Level 2 designs. Level 2 BMPs have design enhancements to boost performance.
- BMPs are sized and designed based on Level 1 and Level 2 design guidelines. The applicable RR and PR rates are based on these sizing and design rules.
- Compliance for water quality is based on the entire site. However, BMP planning is done at the drainage area scale to account for BMPs in series (e.g., rooftop disconnection to grass swale to bioretention). Compliance for channel protection and flood control is done at each point of discharge.
- In the spreadsheet, blue boxes require user input; gray boxes are calculation cells, and yellow boxes are constant values.

Site Data Sheet

1. Utilize environmental site design (ESD) techniques to reduce impervious cover and maximize forest and open space cover. This will affect the post-development treatment volume and pollutant load.
2. For the site, indicate post-development impervious, managed turf, and forest/open space land cover in **lines 22-24**. Guidance for various land covers is as follows:
    a. Impervious = roads, driveways, rooftops, parking lots, sidewalks, and other areas of impervious cover
    b. Managed Turf = land disturbed and/or graded for turf, including yards, rights-of-way, and turf intended to be maintained and mowed within commercial and institutional settings
    c. Forest/Open Space = pre-existing forest and open land, plus land to be reforested (according to standards), that will remain undisturbed and protected in an easement, deed restriction, protective covenant, etc. If land will be disturbed during construction, but treated with soil amendments, reforested according to the standards, and protected as noted above, then it may also qualify for forest cover.

3. From the land cover input, a weighted site runoff coefficient (Rv) will be calculated, as will the required Post Development Treatment Volume, Post Development TP Load, and the required TP load reduction.

D.A. A

4. If the site has multiple discharge points, or complex treatment sequences, it may be beneficial to divide the site into more than one drainage area. Indicate the post-development impervious, managed turf, and forest/open space land cover for Drainage Area A in **lines 16-18**.

5. Apply Runoff Reduction (RR) Practices to the drainage area to reduce post-development treatment volume and load by indicating in **column G** the number of acres to be treated by a given RR practice. Note that some RR practices are divided into turf area and impervious area for treatment. The site designer should select the most strategic locations on the site to place RR practices (e.g., drainage areas with the most developed land). This will likely be an iterative process.

6. Based upon the treatment efficiency of the selected BMP, the spreadsheet will calculate the Adjustment to Treatment Volume in **column I** (the volume of runoff treated by the RR practice, which will be subtracted from the Post Development Treatment Volume), and the Remaining Runoff Volume in **column J**.

7. If a secondary RR practice or a pollutant removal practice will be utilized in sequence downstream of the primary RR practice (for example, 2 acres of impervious rooftop are to be treated first with a green roof, and then, after discharge from the roof, will be conveyed via a dry swale), select the downstream RR practice from the pull-down menu in **column K**. The spreadsheet will then direct the Remaining Runoff Volume to the selected downstream RR practice via **column H**. Sequences of three or more practices can be accommodated as well.

8. Select all the RR practices that will be used for the drainage area. Note that it is possible for a RR practice to be a downstream practice for one area, and a primary practice for another (Using the example above, a dry swale can receive discharge from a green roof and can also receive runoff directly from an impervious parking area.). It is also possible for more than one primary practice to be directed to the same downstream practice. However, the spreadsheet will not allow runoff from one primary practice to be diverted into two different downstream practices. If a site design calls for this, the site will need to be divided into separate drainage areas.

9. From the selected RR practices, the total adjustment to the treatment volume will be calculated on **line 84**, along with the TP load reduction achieved and the additional TP load reduction needed on **lines 89 and 90.**

10. The phosphorous calculations on lines 89 and 90 are based solely on runoff reduction. Several of these practices however, also act to remove phosphorous from the runoff. **Lines 97-118** indicate these pollutant removal

rates for the selected RR practices. **Lines 113-118** include pollutant removal practices that do not provide runoff reduction, and are therefore not included in the RR practice table. Indicate acres of turf or impervious cover in **Columns C and E** if any of these practices will be used as a primary practice. All of the practices on lines 113-118 are considered a final treatment, so secondary treatment options are not provided.

11. The TP load reduction in lines 113-118 is summed, and the remaining TP load reduction needed is indicated on **line 121**.

D.A. B

12. **Lines 4-12** indicate the status of the TP load requirements from sheet D.A. A, illustrating how much more TP load reduction is necessary for compliance.

13. If there is not more than one drainage area for the site, sheet D.A. B should be left blank. If there is more than one Drainage area, fill out D.A. B in the same manner as D.A. A, following 4-11, above.

Water Quality Compliance

14. The water quality compliance sheet summarizes the runoff reduction and pollutant removal results for the site. **Line 16** will indicate whether or not there is remaining TP load to be removed. If there is still a TP load to remove after applying runoff reduction and pollutant removal practices on D.A. A and D.A. B, the site should be reconfigured to reduce impervious or turf areas, or additional RR practices and pollutant removal practices must be selected on sheets D.A. A and D.A.

Channel and Flood Protection

15. This sheet assists with calculation of the channel protection and flood control volumes necessary for the site.

16. Indicate the appropriate regional depths for the 1-year, 2-year, and 10-year 24-hour storms on **Line 2**.

17. In Step 1, each land cover and soil type is associated with a Natural Resource Conservation Service (NRCS) curve number. Using these curve numbers, the total runoff volume for each drainage area is calculated. **Lines 24 and 37** calculates the runoff volume without regard to the RR practices employed on the site. **Lines 25 and 38** then subtract the volume treated by the RR practices from these totals.

18. In Step 2, using the calculated runoff volume with RR practices, it is possible to develop an adjusted curve number that accounts for the RR practices. **Lines 45 and 51** calculate the runoff volume based upon the curve numbers on lines **43 and 49.** Adjust **line 43 and 49** to make the adjusted runoff volume in **lines 45 and 51** match the runoff volume with RR practices

indicated on **lines 46 and 52**. Note that the adjusted curve number will be different for each degree of storm event. These adjusted curve numbers can be used in development of hydrographs and detention volume calculations.

19. In Step 3, indicate the time of concentration for each drainage area on **lines 57 and 62**. This will be dependent upon land cover types, slopes, and flow path lengths. It may also be extended due to the use of certain RR practices. The peak runoff for each drainage area will be calculated on **lines 59 and 64**.

20. Step 4 and 5 should be completed if condition 4 for either the channel protection or flood control regulations is to be used. Otherwise, they can be skipped. Step 4 will calculate the expected runoff volume for a completely forested site similar to how Step 1 calculated the runoff volume for the developed site. In Step 5, indicate the time of concentration for each drainage area on lines **89 and 94.** The time of concentration indicated in Step 5 should be different than Step 3, due to the difference in land cover and topography. The forest cover peak runoff for each drainage area will be calculated on **lines 91 and 96**.

Channel Protection Conditions

21. To meet condition 1, demonstrate that the developed peak runoff from the 2-year 24-hour storm is conveyed without causing erosion of the system.

22. To meet condition 2, demonstrate that the runoff from the developed site, in combination with other existing stormwater runoff, will not exceed the design of the restored stormwater conveyance system nor result in instability of the system.

23. To meet condition 3, indicate the pre-developed land cover types for each drainage area on **lines 111-119.** The pre-developed runoff volume for the 1-year storm will then be calculated on **lines 133 and 145**. Indicate the time of concentration for each drainage area for the pre-developed site on **line 149**. The peak runoff for each drainage area on the pre-developed site will then be calculated on **line 151**. To meet condition 3, the maximum allowable peak runoff from the 1-year storm is equal to the following:

    Allowable $Q_{Developed} = Q_{Pre\text{-}Developed} \times V_{Pre\text{-}Developed} / V_{Developed}$

    Line 156 calculates the allowable $Q_{Developed}$ based upon this equation. **Line 157** indicates the peak runoff from the developed site with no detention. Detention or other means must be provided to reduce the developed peak runoff on line 157 to the allowable peak runoff on line 156. Note that if, on sheets D.A. A or D.A. B, Extended Detention, Constructed Wetlands, or Wet Ponds are utilized, there may already be detention volume available to meet this requirement.

24. To meet condition 4, the maximum allowable peak runoff from the 1-year storm is equal to the following:

Allowable $Q_{Developed} = Q_{Forested} \times V_{Forested} / V_{Developed}$

Line 165 calculates the allowable $Q_{Developed}$ based upon this equation. **Line 166** indicates the peak runoff from the developed site with no detention. Detention or other means must be provided to reduce the developed peak runoff on line 166 to the allowable peak runoff on line 165. Note that if, on sheets D.A. A or D.A. B, Extended Detention, Constructed Wetlands, or Wet Ponds are utilized, there may already be detention volume available to meet this requirement.

Flood Control Conditions

25. To meet conditions 1, 2, or 3, demonstrate that the developed peak runoff from the 10-year 24-hour storm is confined within the stormwater conveyance system.

26. To meet condition 4, the maximum allowable peak runoff from the 10-year 24-hour storm is equal to the peak runoff from the site in a forested condition. **Line 186** indicates the allowable $Q_{Developed}$ based upon this requirement. **Line 187** indicates the peak runoff from the developed site with no detention. Detention or other means must be provided to reduce the developed peak runoff on line 187 to the allowable peak runoff on line 186. Note that if, on sheets D.A. A or D.A. B, Extended Detention, Constructed Wetlands, or Wet Ponds are utilized, there may already be detention volume available to meet this requirement.

27. As condition 5 is dependent upon local determination, it is not included in the spreadsheet.